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Improvement of the Business Banking Credit Process Through the Application of Lean Thinking in a Medium-scale Banking Institution

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Abstract

In a society in constant growth, banking institutions have been forced to satisfy more and more the needs of their clients. Among the most requested services are the bank loans, particularly those intended for medium and large-sized companies. This study deals with the development of a proposal to improve the evaluation stage of the business banking credit process, this stage has a duration of 12 days, generating cost overruns and multiple sources of waste. The implementation of the Lean thinking, Business process management and the use of simulation will be used to achieve the objectives. The results obtained were as expected, demonstrating that by implementing different improvements in certain critical activities, an improvement of 16.12% can be achieved, thus reducing the duration of the stage by 2 days.

Keywords
Banking institution, process improvement, Lean thinking, credit process, Lean tools

1. Introduction

The constant growth of the banking sector has made it more competitive every day. As a result, consumers are increasingly looking for the best options that can satisfy their needs and provide innovative services. One of the main services that has been highly demanded is the granting of bank loans, mainly by the corporate banking department, which is aimed at companies of different sizes and industries.

Currently, due to the Covid-19 pandemic, bank lending to corporate clients has become saturated. This is due to the emergence of new companies that need capital to start their business activities. This study will evaluate the corporate bank lending process of a medium-sized bank and optimize its activities to reduce the turnaround time. The credit process consists of 4 stages: Admission, in which the necessary documentation is requested to prepare and review the initial credit proposal; evaluation, in which the documentation received is verified, recorded and the economic evaluation is performed; approval, in which the applicant company's autonomy is approved and a definitive credit proposal is obtained; and finally formalization, in which a credit line is created, reviewed and approved for the company.

In the quality management system of the banking company there is a continuous improvement process that includes the review of indicators. Through this process it has been possible to detect that the main problem is the number of days that the whole process takes, which lasts 26 days. This research focused on the evaluation stage, where an approximate time of 12 days is estimated, generating cost overruns and multiple sources of waste.

1.1 Objectives

For the correct development of the research, theoretical, methodological and practical justifications were proposed. In the first place, the research is carried out with the purpose of analyzing the evaluation stage of the corporate banking credit process in a medium scale banking institution and recommending the most efficient method to solve the problem of excessive time; due to the fact that there are overdue credit lines, the company cannot make use of them, which causes the loss of income, generating a direct impact. This is a problem that causes banks to lose revenue, generating a direct impact on the profitability of each financial institution, this creates instability, dissatisfaction and ambiguity in the credit evaluation processes (Moura, 2022).

Secondly, it is carried out in order to improve the process in question and to use techniques learned in the Industrial Engineering career.

Thirdly, it is carried out with the purpose of evaluating the possibility of developing an improvement proposal in the evaluation stage of the described process in order to reduce user dissatisfaction and reduce cost overruns.

According to the research objectives, the main objective is to implement improvements that reduce the time of the evaluation stage of the banking company's credit process. Following the previous point, the specific objectives are to apply different methodologies to eliminate waste, improve the process and reduce the cost overruns generated in this stage.

2. Literature Review

The following is a brief description of some of the research that served as a reference for a more in-depth study:

First, there is Lean Thinking, which is a methodology that can be defined as "the set of fundamentals that focus the company and its employees to identify and eliminate unnecessary activities in the business process, leaving only those that create value for the benefit of the customer" (Cardenas & Marin, 2021). In addition, it is considered a philosophy that seeks to provide immediate feedback on processes to convert waste into value for the company, since "specifying value accurately is the first critical step in lean thinking: provide the wrong product or service in the right way generate waste" (Rios, 2019).

As a Lean Thinking support, the authors Romero-Romero, J., and Castro-Rangel, P. (2020), affirm that it´s possible to improve the incidents that constantly occur in response times to customers for personal loans using the Lean Six Sigma methodology. Likewise, to design improvement proposals for Lean Six Sigma systems based mainly on the 5s, Poka-Yoke and DMAIC methodologies. On the other hand, the PDCA (Plan, Do, Check, Act) cycle technique was studied, which mainly seeks quality improvement at all hierarchical levels of the organization and "acts as a guide to carry out continuous improvement and achieve in a systematic and structured way the resolution of problems." (Guerrero, 2018). Likewise, the Lean Change Management model was analyzed, which proposes the use of digital transformation with the aim of automating as many processes as possible and reducing waiting times, which generates an improvement in the organizational structure and innovation of companies (Guerrero, 2021).

Similarly, the influence of Lean tools was analyzed, which are based on using the minimum number of resources in order to get the most out of the resources used and therefore have better efficiency and productivity. Thanks to these tools, it was possible to increase the productivity of the commercial banking process and it was found that regional banks have a faster adaptation to this new methodology (Kolchurina et al., 2020). In addition, the Kaizen methodology was studied, which consists of "raising productivity by improving the work system, reducing time and standardizing processes" (Rodríguez, 2018), for which commitment is required from both managers and workers in order to identify and ensure improvements that contribute to the achievement goals.

In the same way, Lean Service has been used in companies that provide services, increasing the level of customer satisfaction, due to several studies have shown an improvement in both customer service and work environment (Vadivel et al., 2021). Likewise, this tool has a great influence on the way workers manage activities because it is possible to apply improvements in personnel management (Zirar et al., 2021). Also, there are other tools that support Lean service like the value stream map, Ishikawa diagram and the modal analysis of failures and effects, with which

it is possible to achieve a considerable increase in both the efficiency of resources and the productivity of the operational processes of a banking entity (Hidayati et al., 2019).

Continuing with the techniques used in this research, An Ishikawa diagram, also known as a cause-effect or fish diagram, which "is made up of an effect or characteristic that is sought to control or improve by analyzing a set of causes or factors that cause that effect. Each cause generates a branch within the diagram, which may contain sub-causes or even more detailed factors" (Bernal & Niño, 2018). This will allow us to have a better visibility of the causes and factors that affect the development of the process and to discover the root cause that causes this effect. In addition, the Failure Mode and Effects Analysis (FMEA) methodology will be applied, which consists of identifying the problems that occur during a process and trying to eliminate or mitigate them to provide a better experience to end customers. "To do this, its implementation must be carried out starting from the identification of all possible existing failures and categorizing them according to their priority, in this way it is possible to focus its action on those that damage the unit under study to a greater extent" (Rojas, 2019). Also, process simulation, which is based on the experimentation of a set of series or activities in a given system, is one of the vital tools for industrial engineering and was used in order to "improve a process or explore some improvements having modifications in the represented process" (Benites, 2020).

Similarly, the Excel program is used to process the information and maintain order in the classification of data (Vilca et al.,2021). The diagramming of activities was considered fundamental for a good understanding of the process contributed to bring order and planning to identify activities that do not generate added value to the process and helps to eliminate them, optimizing the time used (Rizkya et al., 2018). The time study, which is important to determine the time needed to complete the process, task or activity (Salvendy, 2001).

The methodology based on Business Process Management (BPM), is defined as a management practice whose main objective is to improve the agility and operational performance of business processes (Lee & Dale, 1998). This made it possible to visualize the initial scenario and to develop an improvement in the process to achieve the objectives. This methodology has been used in different investigations that seek the improvement of a process, its use is mainly due to the fact that it establishes a starting point for the analysis of the activities and stages of a studied process. Likewise, Lean Thinking which has been applied in different investigations focused on the banking sector, has been used to eliminate waste that affects the response times of the processes.

3. Methods

To carry out this research, an experimental methodological design was chosen because it is an investigation that consists of "identifying and quantifying the causes of an effect within an experimental study and also deliberately manipulating one or more variables, linked to the causes, to measure the effect they have on another variable of interest" (Gabriel et al., 2021) in addition to being a case study because research of this type is empirical, investigates a contemporary phenomenon and multiple sources of evidence are used for its realization (Yin, R.K, 1984). Similarly, the scope of the research is focused on two types, which are exploratory and descriptive. The purpose of the exploratory scope is to investigate problems that have been little studied, to prepare the ground for new studies, to investigate from an innovative perspective, among others. Regarding the descriptive scope, work is done on a studied phenomenon, variables are defined, and concepts are measured (Hernández Sampieri et al., 2014).

Continuing with the research, a quantitative-qualitative approach was chosen due to the nature of the objectives; a quantitative approach is defined as "a systematic and orderly process that is carried out following certain steps" (Monje Álvarez, 2011). Similarly, the characteristics it possesses are the use of statistics, the measurement of phenomena, among others. Due to these qualities, the benefits are precision, prediction and control over the phenomena studied. On the other hand, a qualitative approach is used, since data collection is used "to finish the research questions or reveal new questions in the process of interpretation and this is done through different types of data, such as interviews, observation, documents, images, audios, among others" (Hernández Sampieri et al., 2014). As a consequence of these approaches, the chosen orientation is the improvement of processes, selected because a possible solution will be proposed to reduce the time of a specific stage of the process based on an initial diagnosis. (Monje Álvarez, 2011)

The variables defined for the research are fundamental for a good performance of the work; that is why the first main variable was defined as the productivity of the process, where the efficiency of the process was defined as a dimension. For the correct analysis of this variable and its dimensions, the indicator of Documents attended/Documents received was used. For the purposes of the research, a second indicator of Documents approved/ Documents received was used.

Another variable used is the hours invested in the process. For a correct analysis, the indicator of hours was used for analyzing a document. For the purposes of the research, this indicator was only applied in a specific scenario where the analyzed document goes through activities that demand many hours to be approved.

To obtain the results, we started with the identification of the main activities to have a current context and the process was classified into possible scenarios; as a second step, a SIPOC was performed to have an overview of the studied stage of the process where the inputs and outputs of the process can be appreciated; In the third step, the Failure Mode and Effects Analysis tool was applied to classify the problems that arise when evaluating a request; as a fourth step, an Ishikawa diagram was used to determine the root causes of the main problem identified in the previous step; finally, after eliminating the root causes of the problems, a simulation was carried out with a new scenario where the activities are optimized.

4. Data Collection

With respect to the data collected, the companies were classified, and it was determined that only 5440 companies are medium and large; of this result, only 3169 apply for loans and are in the range of larger operations, the latter being the population used. Secondly, the formula was used to determine the sample size, where a result of 321 companies was obtained. As an observation, a value p= 50%, q=50%, error of 5% and a confidence level of 98% were used to calculate the sample. Likewise, with respect to the process times, a total cycle time of 26 days was obtained, which is divided into four stages where the total time for admission is 7 days, 12 days for evaluation, 4 days for approval and 3 days for formalization. The research focused only on the evaluation stage, which has 9 activities. In this first stage, the mapping of the process activities is used, with the help of which the 9 activities in the evaluation stage of the process under study were identified. The activities and times were obtained through a document describing the process, and several interviews were conducted with an expert in the banking area of the company to verify the information.

In turn, it was determined that the process can be classified into 3 possible scenarios: in an ideal scenario, where the documents are approved, the approximate time is 56 hours; in a pessimistic scenario, where the documents are rejected, the time can reach 97 hours; and in a realistic scenario, the time is 93 hours. For practical purposes, in this research only the realistic scenario of 93 hours has been considered, where the analyzed documents are approved to move to the next approval phase, which is reflected in Table 1 and Figure 1.

Table 1. Activities in the realistic process scenario

Owner	Activity	Processing time (hours)
Enterprise Risk Analyst/Senior Enterprise Risk Analyst	1. Receive files.	13 hours
	2. Verify documentation. • If not compliant, end of procedure • If compliant, go to 3	6 hours
	3. Verify autonomy. • If it has autonomy, end of procedure. • If it does not have autonomy, go to 4.	10 hours
	4. Evaluate operation, the credit risk is evaluated.	24 hours
	5. Verify if the evaluation is compliant. • If it is, go to 6. • If not, end of procedure	8 hours
	6. Confirm in Fitbank, turn to 7.	1 hour
Senior Enterprise Risk Analyst with autonomy/Head of Enterprise and Market Risk Dept.	7. Solve operation.	24 hours
	8. Verify conformity. • If not, end of procedure. • If it is, go to 9	6 hours
	9. Approve operation.	1 hour

After ordering and analyzing the activities of the process studied, we proceeded to the diagramming of the process with the help of the Bizagi program. This will help to have a more accurate view of the process flow, as well as being a visual aid.

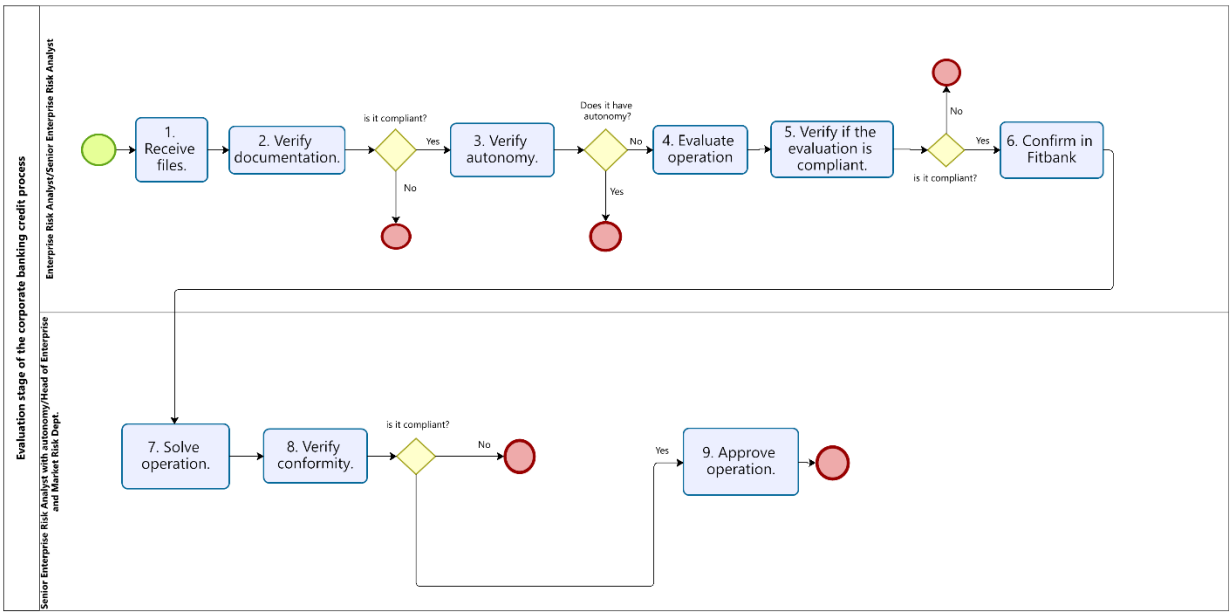

Figure 1. Flowchart realistic process scenario

Similarly, for a better understanding from an overview, a SIPOC was used in Table 2.

Table 2. SIPOC Structure

Evaluation stage in the corporate banking lending process				
Initial Limit Admission Stage			Outer Limit Approval stage	
Suppliers	**Input**	**Process**	**Output**	**Customer**
Business Officer Head of the corresponding Commercial Department Enterprise Risk Analyst	Initial credit proposal Customer file	Economic evaluation	Final credit proposal Customer file	Management Assistant Business Officer

After performing the correct analysis of the process studied, we proceeded to identify the current problems that arise. In order to carry out this exercise, those responsible for the previously mentioned activities were consulted, thus providing accurate information that is closer to the reality of the process. Among the problems identified are: Constant document verifications, incomplete or outdated information from the applicant, no standardized procedure, no time limit for processing documents in each activity, receipt of incomplete documents in the first activity, and dependence on communication with other areas. In order to classify these problems, the Failure Mode and Effect Analysis (FMEA)

was used, as shown in Table 3, where the problems were prioritized according to their severity, frequency and detectability. A rating of 1 - 10 was used to calculate an RPN less than or equal to 1000.

Table 3. Failure mode and effect analysis

Key Process Steps	**Potential Failure Modes**	**Potential Failure Effects**	**Potential Causes**	**Occurrence Controls**	**Recommended Actions**	**Resp.**	**GRAVITY**	**FREQUENCY**	**DETECTABILITY**	**RPN**
What is the process step?	*In what ways can such a step in the process fail?*	*What is the impact of key step variables when there is a failure (customer or internal requirements)?*	*What causes the key step to fail?*	*What are the existing controls and preventive Cause or Failure Mode procedures?*	*What are the actions to reduce Cause Occurrence or improve Detection?*	*Who is responsible for the recommended actions?*				
Evaluation	Constant verification of documents	Delays in the proposal evaluation process	Too many controls and repetitive activities	None	Automate customer capture and registration from the web platform	Business assistants	7	7	8	392
Evaluation	Incomplete or outdated customer information	Generate more activities and interactions with clients to regularize information	Lack of knowledge of clients about the information to be provided	Manual verifications of customer data	Prepare a check list of documents requested from customers.	Business officer	8	7	6	336
Evaluation	There is no standardized procedure	There is no standardized procedure It is based on the knowledge and capacity of the staff and not specifically on the process.	Lack of formalized policies and procedures	Total average time of attention	Formalize policies and procedures in the credit evaluation and disbursement process.	Corporate banking manager and process analyst	8	6	6	288
Evaluation	There is no time limit on the processing of documents for each activity.	Delays in evaluation	There is no time and motion study of the process.	Total average time of attention	Standardize and automate the process by establishing attention times for each activity.	Process analysts	7	5	5	175

Once the FMEA was carried out, it was determined that the main problem affecting time at this stage of the process is the constant verifications of documents. At the same time, an Ishikawa diagram was made where the possible root-causes of this problem were found, in order to propose possible solutions (Figure 2).

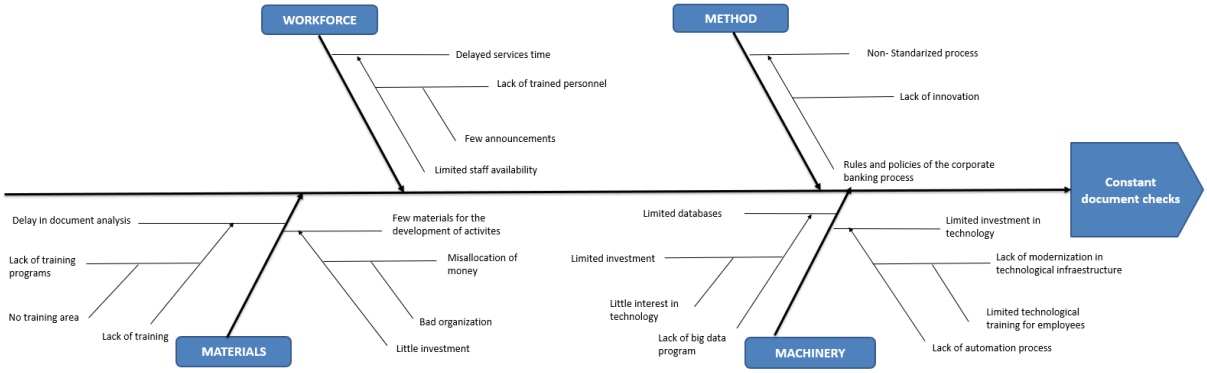

Figure 2. Cause-effect diagram

As can be seen in the diagram, the main causes of the problem of the delay in the corporate banking process are mainly due to four reasons:

- The process is not standardized due to the rules and policies of the corporate banking process of the bank, this is due to a lack of innovation and development by senior management.
- The limited investment in technology and the limited database available are due to a limited investment and lack of modernization of the technological infrastructure.
- The limited availability of personnel causes delays in service times and the fact that most of the staff is working in the main office causes longer delays in the review of documents in the agencies.
- Finally, having few materials for the development of activities due to poor investment, which in turn is generated by poor distribution of goods and poor organization.

5. Results and Discussion

5.1 Numerical Results

We chose to analyze the first 3 quarters because these are stable months where requests do not fluctuate and are maintained in a linear growth line. It should be noted that all indicator data were validated by company documents and truthful information provided by the process expert. Likewise, the Excel program was used to make the calculations and projections. The productivity indicators were improved, a comparison of before and after the improvement was made in Table 4.

Table 4. Before and after of Indicators

Indicators	Before	After	% improvement
Process productivity (9 months)	212 analyzed documents	245 analyzed documents	15,69 %
	124 approved documents	147 approved documents	18,55 %
Hours invested in the process (realistic scenario)	93 hours	78 hours	16.12 %

From the results obtained in this research, we conclude the following: the constant verification of documents is the main problem that generates delays within the evaluation process, since it has an RPN of 392 in the FMEA matrix, in addition, it was determined that, based on the proposals proposed, the activities that generated the greatest bottleneck (30 hours) could register improvements in a range of 12 to 21 hours. In order to have a more realistic scenario, these ranges were applied in a simulation in the Arena program replicated 321 times (calculated sample number), where a total average time of 78 hours was obtained, which represents an improvement of 15 hours or 2 working days. Regarding the constant waiting times that generate dissatisfaction among users when applying for loans, the analyzed and approved documents were evaluated, where improvements of 15.69% and 18.55%, respectively, were recorded.

Likewise, it should be noted that the results obtained are similar to the research conducted by Rizkya, I., Syahputri, K., Sari, R. M., and Siregar, I, where verification times were the cause of excessive delays in granting bank loans to individuals, which is why in this research this type of activity was considered critical and an opportunity for improvement.

5.2 Graphical Results

The growth trends were performed to have a visual impact and to see the evolution before and after the implementation of the improvements, as we can see in the following Figure 3:

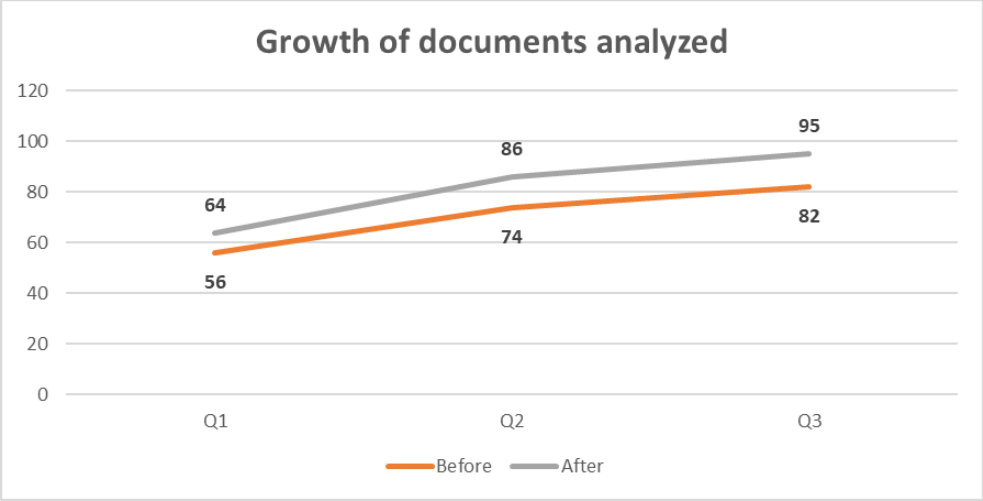

Figure 3. Before and after of documents analyzed

5.3 Proposed Improvements

In order to achieve the results presented above, 3 improvement proposals were made: First, it is recommended to implement a Credit Score focused on bank loans to companies, the function of which is mainly to predict an applicant's profile through a score that will determine whether or not he/she is suitable for the granting of the loan, which will greatly speed up the credit evaluation stage since there will be a possible profile of the applicant and a reference; currently the bank does not have this system, which makes it difficult to process applications. In order to successfully implement a credit score, it is necessary to standardize a procedure where at the admission stage of the process a folder is requested with the necessary information such as proof of payments, credit history, complete profile of the applicant, among others that can feed a database; although it is true that documents are requested at the beginning of the process, these are usually incomplete or outdated. It is also important to comply with the methodology of the five C's of credit, which are capacity, character, capital, collateral and conditions.

Another proposal is to implement the homologation of the information that is stored between the risk area and the company's banking system; many times the poor control of the information delays the flow of the process, thus generating delays. Finally, as a last proposal, the use of automated systems is recommended because human error when filling in data is a source of delay in the process.

5.4 Validation

After the proposed improvements were validated, the main activities that benefited from them were determined, which were the documentation, autonomy and conformity verifications that together add up to approximately 30 hours; these activities are the cause of the bottlenecks that delayed the process, this is because in many occasions updated or missing documents were requested and therefore generated a wait that prevented the progress of the request for the rest of the activities. According to Santa Cruz Yactayo, J. (2021) it is possible to reduce man-hours in a process by up to 89% by implementing Industrial Engineering tools such as automation and process redesign (p. 117).

Table 5 shows the activities with the current times and an estimate of new times based on a range considering the scale of the bank, the number of employees performing the activities and the implementation of the proposed improvements. An approximate reduction of 55% has been considered in 4 key activities which are verify documentation, verify autonomy, verify if the evaluation is compliant and verify compliance.

Table 5. Activities benefited by the improvements.

Activities	Ancient time	New time (range)
Verify documentation	6 hours	1 – 3 hours
Verify autonomy	10 hours	3 – 6 hours
Verify if the evaluation is compliant.	8 hours	5 – 7 hours
Verify if the evaluation is compliant.	6 hours	3 – 5 hours

As mentioned above, the Arena program was used to perform a simulation, where the new time ranges were used in the respective activities and were replicated 321 times, a number that represents our sample. This can be visualized graphically in Figure 4.

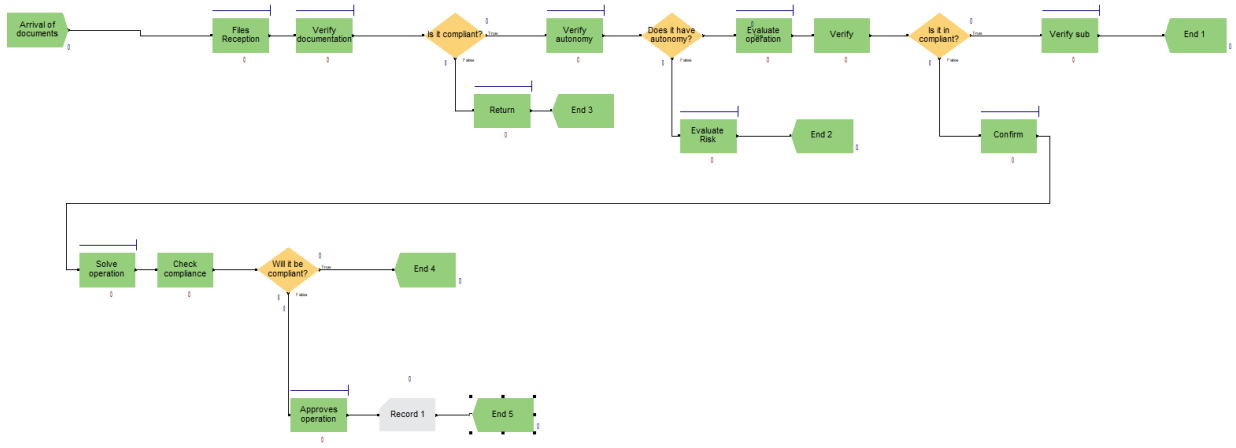

Figure 4. Arena simulation

6. Conclusion

Finally, with respect to the objectives of the research, the main objective was achieved, which was to implement improvements to reduce the attention time in the evaluation stage of the credit process of the banking company. In order to meet this objective, several limitations had to be overcome, such as contacting the customer service personnel to obtain the necessary access to enter the entity, as well as scheduling a meeting with the analyst and the manager of the corporate banking area so that they could provide us with more detailed information on the credit evaluation processes and their main problems in executing them.

As conclusions, it was determined that it is possible to improve the attention time in the activities of a process through different methodologies, in the particular case of the study through the use of Lean Thinking, which helped greatly to eliminate the dead times that occurred in the critical activities previously analyzed. Likewise, the use of different engineering tools allowed us to first identify the root cause of these problems, and based on this we were able to perform a more detailed analysis of the process and a simulation that showed us that by implementing the proposed improvements, the evaluation process would be carried out in two working days less. In addition, the number of documents analyzed per year would increase by an average of 15%.

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Biographies

Sebastian Gratelly Holder of a bachelor's degree in industrial engineering with a specialization in Lean Manufacturing from the University of Lima, he has solid experience in leadership of continuous improvement projects and processes. His expertise extends to the application of ISO standards, Lean Six Sigma methodologies and other process improvement strategies, demonstrating an unwavering commitment to management excellence. Throughout his career, he has achieved significant improvements in productivity and quality, and seeks to apply his skills and knowledge to drive operational efficiency and innovation in dynamic industrial environments.

Alonso Geronimo Holder of a bacherlor´s degree in Industrial Engineering with a specialization in Data Analytics from the University of Lima, he has experience in data-driven decision making and improvement of business forecasting models. His knowledge extends to process improvement strategies, impacting on the performance of the productvity. Among his main achievements, are the optimization of reports and improvements in customer clustering.

Nicolas Salazar a vital member of the Universidad de Lima since 2008, stands out as an educator and researcher specialized in ergonomics, research projects and work design. His teaching experience covers fundamental courses in these disciplines, influencing the academic development of students over the years. With an outstanding career in academia, he has contributed significantly to the body of knowledge in his field. His work as a researcher is reflected in the publication of numerous articles in various journals, consolidating his reputation as an expert in ergonomics and work design. PhD from West Virginia University in Morgantown, WV, USA, brings an international perspective to his teaching. His commitment to academic excellence and research has left a lasting mark on the institution and has inspired students to explore the complexities of these disciplines. His holistic approach to education and research has made him a respected and influential figure at Lima University.